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# Nuclear Chemistry Lab 1: Radioactive Simulation

## Introduction

Radioactive atoms release different forms of radiation to become stable. This activity simulates the radioactive decay of an atom. The radioactive atom under investigation will be either M&Mium (M&Ms) or Skittlium (Skittles). Each piece represents a radioactive atom. Once the "atom" emits radiation a new stable atom will be formed.

**Question / Aim:** To discover what half life on an element represents
**Independent Variable:** Shakes which represents time
**Dependent Variable:** Decayed elements
**Controlled Variable(s):** Type of candy, time between each measurement

## Design

### Supply List

100 candy pieces, resealable bag

### Procedure

1. Begin with a bag of M&Mium (M&Ms) and **count the total atoms that you begin with**. Record this number in the data table on pg 2.

2. Place atoms (candy pieces) in the bag.

3. Seal the bag and gently shake for the specific amount of time that corresponds to the half-life of your candy. **Half-life: M&Mium (M&Ms) = 5 shakes.**

4. Gently pour out the candy on a paper towel. Don't let any fall on the floor - they are radioactive!!!

5. Count the number of pieces with the print side up. These atoms have "decayed" and are now stable. Record this number in your data table.

6. **Return only the pieces with the print side down to the bag. Reseal the bag.**

7. **Set the "decayed" atoms to the side.**

8. Record the total time elapsed in your data table. (For M&Ms it would be 5 shakes on the first trial. On the second trial it would be 10 shakes total (5 shakes + 5 shakes). On the third trial it would be 15 shakes total (5 shakes + 5 shakes + 5 shakes) and so on).

9. Gently shake the sealed bag again for the prescribed amount of time. Refer to half-lives above.

10. Continue shaking, counting, recording, and setting decayed atoms aside until all the atoms have decayed. Don't let any fall on the floor - remember they are still radioactive!!!

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## Results

*Table 1: Number of M&Mium Atoms as it Goes Through Nuclear Decay*

| Total Time (Total number of shakes) | Total number of decayed atoms | Number of radioactive atoms remaining |
|---|---|---|
| 0 | 0 | |
| 5 | | |
| 10 | | |
| 15 | | |
| 20 | | |
| 25 | | |
| 30 | | |
| 35 | | |
| 40 | | |
| 45 | | |
| 50 | | |

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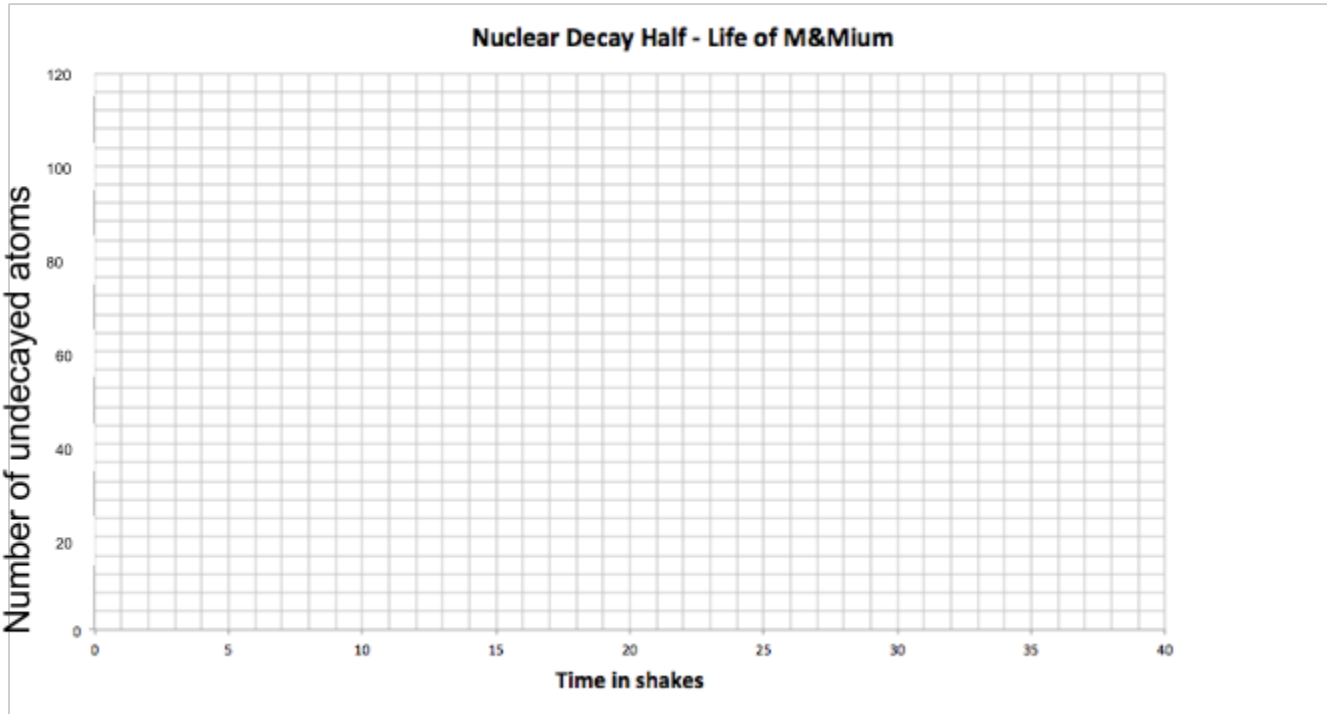
1. **Make a graph of the number of atoms vs. time (in shakes).**
   You will have one line: 1) Radioactive atoms (number of undecayed vs. time)




## Evaluating Results

### Conclusion

1. Go to the graph and find the point when half of the atoms have decayed (50 atoms). Follow this to the x-axis and draw a vertical dotted line at this time. **Mark this line 1st Half-life.**

   What is this time in shakes? _____ shakes.

2. Repeat for half of 50 atoms (25 atoms). Draw a vertical dotted line at this time and **mark this line 2nd Half-life.**

   What is this time in shakes? ____ shakes.

3. Repeat for half of 25 atoms (12.5 atoms). Draw a vertical dotted line at this time and **mark this line 3rd Half-life.**

   What is this time in shakes? ____ shakes.

4. Look at your graph, how many shakes are from 0 shakes to the 1st Half-life? ____ shakes

5. Look at your graph, how many shakes are from the 1st Half-life to the 2nd Half-life? ____ shakes

6. Look at your graph, how many shakes are from the 2nd Half-life to the 3rd Half-life? ____ shakes

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7. Average the numbers from 4, 5, and 6 to find the average Half Life for you atom. Show your work below. Numbers must include units!

8. Let's say each shake represents 10 days.
   a. What is the half-life of your atom in days? Numbers must include units!

   b. If you start with 200 atoms of your atom, how many days will it take before half of these are radioactive? Numbers must include units!

   c. How many days will it take until only 25 radioactive atoms are left? Show work or explain. Numbers must include units!

   d. Let's say you start with 1000 grams of your atom. Complete the table below.

| # Half Lives | # of days that have gone by | # of Radioactive grams left |
|---|---|---|
| 0 | 0 | 1000 |
| 1 | | |
| 2 | | |
| 3 | | |

9. Can you predict when a specific individual “M&Mium” atom will decay? Explain.